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Water and Culture

Pictures and Students abroad

**Column from Huub Savenije about
his *Headstrong Students***

**Looking back at the *Intense Rain Event* in October 2013
with Marie-claire ten Veldhuis**

A review of the October Rain and the climate resilience of Rotterdam



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On the 12th and 13rd of October, a heavy rainfall event hit the West of the Netherlands and caused flooding especially in the region around Rotterdam-Rijnmond. The KNMI meteorological station at Rotterdam airport registered 64.1 mm on 12-13 October, while some areas in Rotterdam and the surrounding region received more than 100 mm in 24 hours (figure 1). Prolonged rainfall over the period 10 – 14 October amounted to between 150 and 200 mm in some areas. Let's have a look at how extreme this event really was, what damage occurred and what was done to prevent it.

The rainfall event, rainfall volumes and return period
From Friday 11 October to Sunday 13 October 2013, a rotating front above the western part of the Netherlands caused a lot of rainfall. The front was part of a low pressure area located above northern France, from which a separate low pressure core developed, which moved to the South Holland coast and rotated for hours until it slowly moved on towards England. Precipitation volumes of 100 mm in 24 hours have an expected return period of more than 100 years (source: KNMI, 2011. Brochure neerslagstatistiek). Figure 3 shows areal rainfall over 1000 km² areas, corresponding with the approximate density of KNMI automatic weather stations. Note the areal reduction effect: while point rainfall amounted to well over 100 mm at several locations, only a small area received over 100 mm at the 1000 km² scale. Corresponding return periods amount to over 30 years, at the large spatial scale of South-Holland, Zeeland and Utrecht, as shown in figure 2, on the right (source: KNMI¹). The probability of these events has changed in the past century. In the current climate such an extreme rainfall event has twice the chance of occurrence compared to half a century ago. The probability of this type of events occurring in autumn is expected to increase still by a factor 2 until 2050 (KNMI¹).

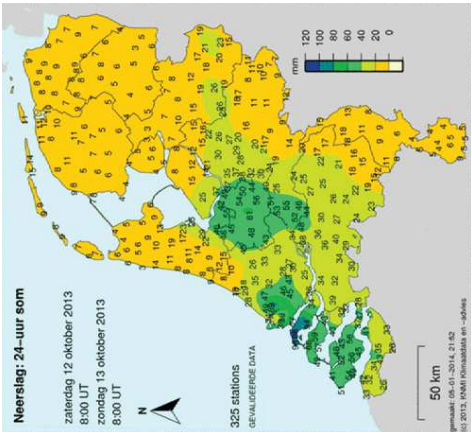


Figure 1. Daily rainfall 12-13 October, based on weather stations KNMI.

Complaints and damage
According to Alarmeringen.nl, a website that collects calls from emergency services throughout the Netherlands, fire brigades came in action 3787 times, including 1002 calls in Rotterdam-Rijnmond region. The Association of Insurers estimated damage to private households at about €0.5M million, while damage to agriculture was estimated at several million Euros, especially due to losses to potato harvests.

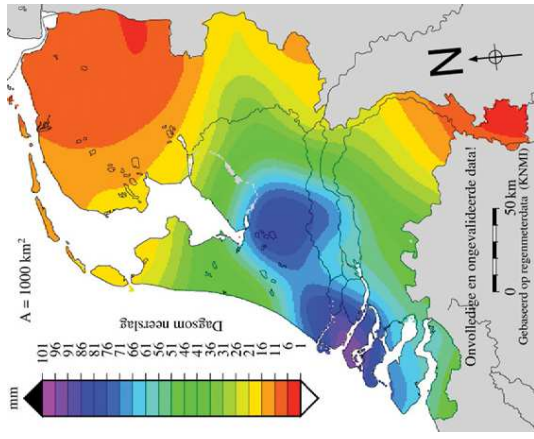
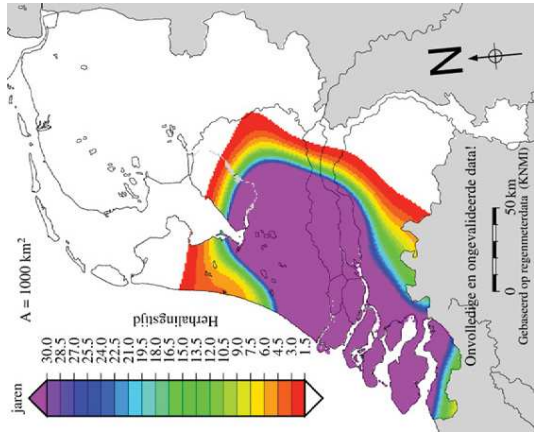


Figure 2. Accumulated 24-hour rainfall between 12 October-13 October evenings (left), based on KNMI weather stations data. A point on the map represents average rainfall over an area of 1000 km² (approximate density of KNMI automatic weather stations).



Estimated return periods of 24-hour, 1000 km² areal rainfall (right), derived from extreme value statistics; based on these data, rainfall volumes of over 75 mm in 24 hours on this spatial scale parts of Zeeland, Zuid-Holland and Utrecht) occur less than once in 30 years.



Figure 4. Installation of mobile pumps

In Rotterdam city, the local fire brigade and city call centre received a total of 330 notifications of pluvial flooding, mostly related to flooded basements and blocked sewers and sewer inlets. Occurrence of combined sewer overflows was widespread, as most of the city is equipped with combined sewer systems and rainfall volumes largely exceeded in-sewer storage capacity.

Actions by water authorities

Upon receiving predictions of extreme rainfall for the 12-13 October weekend, HH Delfland decided to preventively lower polder water levels (figure 3, blue line, lowering of water level in Delft). The Westland boezem system (red line in the graph on figure 3) responded very rapidly to rainfall from 12 October midnight on. On 13 October, calamity storage polders were filled to prevent water levels from rising further. During the event, all 4 calamity storage polders in the Delfland area were filled and 40 additional mobile pumps were installed to control boezem water levels.

In Rotterdam city, the large underground storage basin (10,000 m³) in the city centre was filled during the event, as well as the two newly constructed water squares. All sewer overflow pumps from the city polders to the river Meuse operated at full capacity. Waterboards Hollandse Delta and Schieland and Krimpenerwaard installed 5 mobile pumps at various critical locations in Rotterdam to relieve polder water systems.



Figure 4. Water square Bentheimplein

Rotterdam region climate proof:
The number of complaints and damage claims produced by the extreme rainfall event on 12-13 October 2013 have remained relatively low given the large rainfall amounts that hit some areas in the Rotterdam-Rijnmond region. Water authorities have been on the alert and have effectively taken preventive and calamity measures. The nature of the event, with prolonged rainfall at moderate rainfall intensities has allowed water authorities to be well prepared and take timely action to control rising water levels. Still, all damage could not be prevented; especially in densely built areas where polder water systems and underground sewer systems closely interact flooding has proved hard to control. In the future, when the new rain radar will be installed on one of the high-rise buildings in Rotterdam City Centre, water authorities should be able to even better cope with heavy rainfall, especially with more intense and concentrated storms that are so critical for urbanised areas. Rotterdam region will be made climate proof to rainfall events at all scales.

Note on return periods: return periods of rainfall that have been calculated for this event vary from 30 to over 100 years for 24 hour rainfall volumes. This large variation is explained by variability in the data source used and in variability in the area considered and how areal rainfall was calculated. Source data included interpolated weather station data, radar data or adjusted radar data based on weather stations. Areas considered to calculate rainfall amounts vary from point scale (area of a rain gauge) through polder scale up to 1000 km² and scale of the entire event (South-Holland-Zeeland-Utrecht).

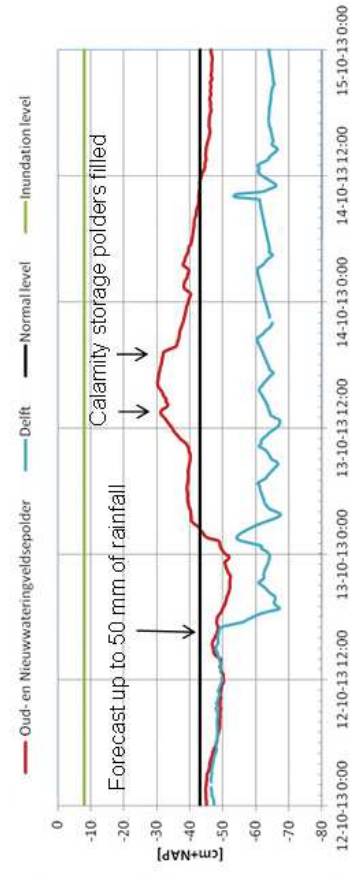


Figure 3. Water level variations between 12 and 15 October in the "boezem water system" of Delfland at 2 locations, Delft and Westland; normal water level and inundation level are also indicated in the graph.

More details are provided at the KNMI website: www.knmi.nl/klimaat-og/e/neerslag_0kt13.html



Read more about the new rainfall radar at www.raingain.eu

